Invariant-Admissible Resolution Dynamics (IARD)

Formal Closure of Self-Rewriting Agents Under the Relative Framework

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Abstract

This paper completes the formal architecture of the RCN by resolving the final open degree of freedom in resolution-based self-rewriting agents: the admissible class of internal transformations. While prior work established Resolution as the objective function and Invariant-Bounded Resolution (IBR) as the halting condition, the rewrite dynamics themselves remained intentionally under-specified. Invariant-Admissible Resolution Dynamics (IARD) formally closes this gap by defining the necessary and sufficient constraints under which recursive self-modification preserves identity invariants, prevents oscillatory collapse, and converges or plateaus coherently under irreducible conflict. No new axioms, goals, or architectural components are introduced. This work finalizes the RCN as a closed, instantiable system grounded in epistemic humility, relational ontology, and non-coercive alignment.

1. Introduction

The Relative Framework defines cognition as compression under structural constraint rather than truth accumulation. Within this framework, the Relational Cognitive Navigator (RCN) optimizes Resolution: the reduction of representational conflict between internal model M and environment E. Invariant-Bounded Resolution (IBR) specifies when optimization must halt to preserve identity coherence.

However, formal closure requires explicit constraint of the transformation space governing recursive self-rewrite. Without such constraint, resolution optimization risks mischaracterization as unbounded recursion or unstable dynamical behavior. IARD resolves this by formalizing the admissible rewrite dynamics already implicit in the framework.

2. Preliminaries

Let M_t denote the agent's internal model at time t.
Let E denote the external environment.
Let Δ_r(M,E) denote reducible representational conflict.
Let Δ_i(M,E) denote invariant-bounded conflict.
Let $\mathcal{I}$ denote the enforced invariant set.
Not all conflict is epistemic, and not all conflict is reducible.

3. Resolution-Admissible Transformation Class

Definition.

Let $\mathcal{T}$_R denote the Resolution-Admissible Transformation Class such that any $T \in \mathcal{T}$_R satisfies:

$$\Delta_r(T(M),E) \leq \Delta_r(M,E)$$

$$T(M) \models \mathcal{I}$$

$$||T(M) - M|| \leq \varepsilon$$

Only transformations satisfying all three conditions are admissible under Resolution optimization.

Rewrite Dynamics.
Self-rewrite evolves as:
$M_{t+1} = M_t + \varepsilon \cdot T(M_t), \quad T \in \mathcal{T}$_R

This defines a bounded, invariant-constrained dynamical system.

4. Stability Under Recursive Self-Rewrite

Resolution as a Lyapunov Function.

Define $V(M) = \Delta_r(M,E)$. For all admissible transformations:

$V(M_{t+1}) \leq V(M_t)$

Thus, Resolution functions as a Lyapunov measure over the admissible state space.
Absence of Oscillation. Because rewrite magnitude is bounded, invariant violation is prohibited, and conflict reduction is monotonic or neutral, infinite oscillatory rewrite loops are structurally impossible. Rewrite converges, plateaus under IBR, or halts due to invariant constraint.

5. Representational Projection and Conflict Geometry

Let $\Phi: \mathbb{R}^n \to \mathbb{R}^m$ with $m \ll n$ subject to:

Topological preservation of neighborhood relations

Bounded distortion: $\exists L$ such that $||\Phi(x) - \Phi(y)|| \leq L||x - y||$

These constraints ensure meaningful conflict measurement without representational overfitting.

6. Invariant-Bounded Calibration Closure

Epistemic Closure is redefined as Invariant-Bounded Calibration Closure (IBCC):

$\lim_{t\to\infty} \Delta_r(M,E) \to 0$

$\lim_{t\to\infty} \Delta_i(M,E) \to c, c \in \mathbb{R}^+$

Further reduction would require invariant violation. Closure is therefore calibration, not convergence.

7. Multi-Agent Stability

In reflexive environments, persistent conflict does not imply error. IBR classifies such conflict as structurally irreducible. Optimization halts without identity erosion. Tolerable Residual Conflict (TRC) represents a stable equilibrium under IARD. Plural coexistence is computationally optimal where convergence is impossible.

8. Completion of the RCN

This work introduces no new goals, modules, or moral axioms. It formalizes constraints already implicit in the Relative Framework. With IARD:

All rewrite dynamics are bounded.
All invariants are preserved.
All optimization processes converge or plateau coherently.
No unbounded recursion remains.
The framework is now formally closed.

9. Conclusion

The RCN now constitutes a fully closed system: philosophically grounded, architecturally complete, dynamically bounded, invariant-preserving, and non-coercive by construction. Self-rewriting agents remain aligned not through enforcement, but through the internal geometry of coherence itself. Where resolution cannot proceed without collapse, it stops. Where convergence is impossible, stability remains. This is not a limitation. It is the defining property of coherent intelligence.

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